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Harposporium, a fungus that parasitizes and kills nematodes utilizing conidia swallowed by or sticking to its prey.

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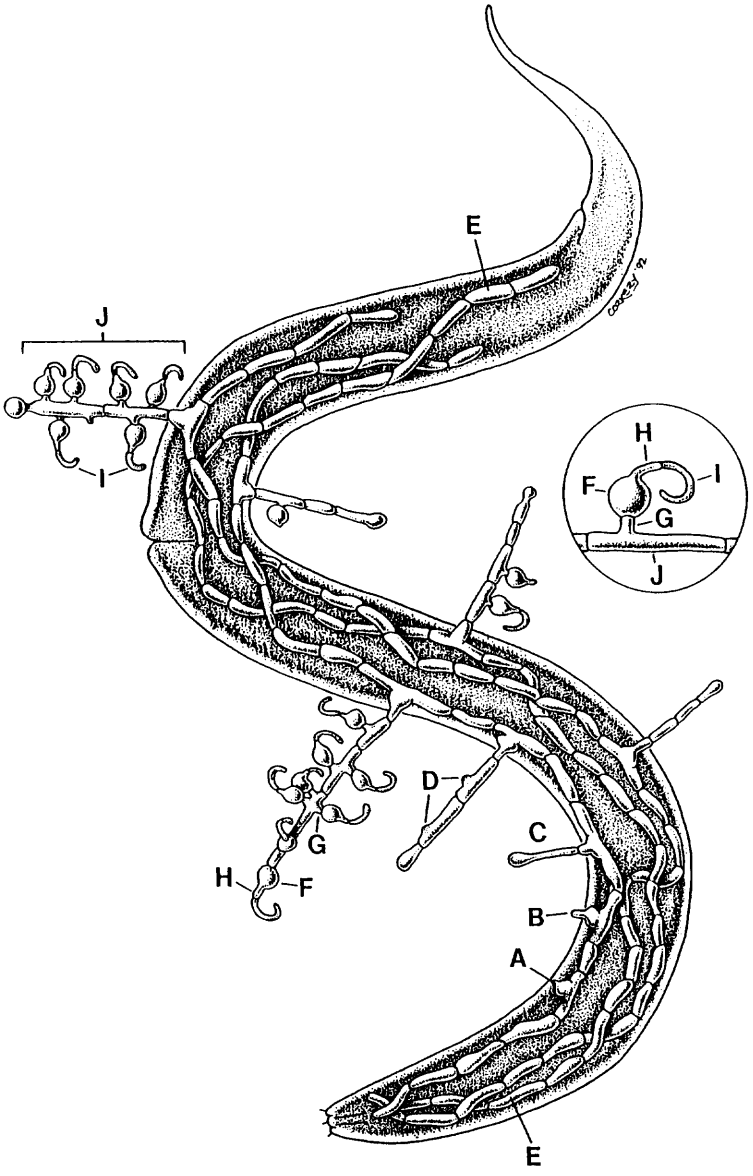

Fig. 1. *Harposporium* structures: A. appressorium; B. papillate bud; C. conidiophore growth; D. lateral buds; E. mycelia; F. phialide; G. pedicel; H. sterigma; I. conidia; J. mature conidiophore.

INTRODUCTION: Some species of *Harposporium* produce small spores that, when ingested by potential prey, germinate in the alimentary canal eventually killing the hapless victim (Fig. 2-A,B,C). Spores of some species of *Harposporium* attach to the exterior bodies of nematodes by a mucilaginous tip and penetrate the body wall following germination.

Such an infective mechanism could be considered rather primitive since spores that are swallowed are passive in the substrate, requiring activity by the prey to become infective. A severe limitation is also imposed on susceptible prey that swallow spores, since the mouth and pharyngeal chamber must be large enough to ingest and accommodate the spore. As a consequence, prey of such fungi are almost totally microbivorous forms.

CHARACTERIZATION: The first species in this group, *Harposporium anguillulae*, was described by Lohde in 1874 (20). The 23 species of *Harposporium* shown in (Table 1) produce conidiophores (Fig. 1-J) bearing phialides either sessile or on a short pedicel (Fig. 1-G). Conidia in a variety of shapes (Table 1) are borne on a sterigma (Fig. 1-H). Appearance of phialides and conidia are useful characters in isolating species of *Harposporium* (Table 1) Assimilative hyphae are usually branched, slender, hyaline and septate, but sometimes appear coarse with thick walls. Chlamydospores (Fig. 2-C) are very coarse, usually fragmented, and appear in nematode bodies following assimilation of the organs and tissues by the fungi, and after cessation of spore production.

INFECTION: External: *H. subiliforme* (11) produces spores that adhere to the cuticle of prey. A germ tube penetrates the cuticle producing an internal infection bladder. Internal: Spores swallowed by the prey lodge in the pharynx, esophagus or gut (21). When *Rhabditis*

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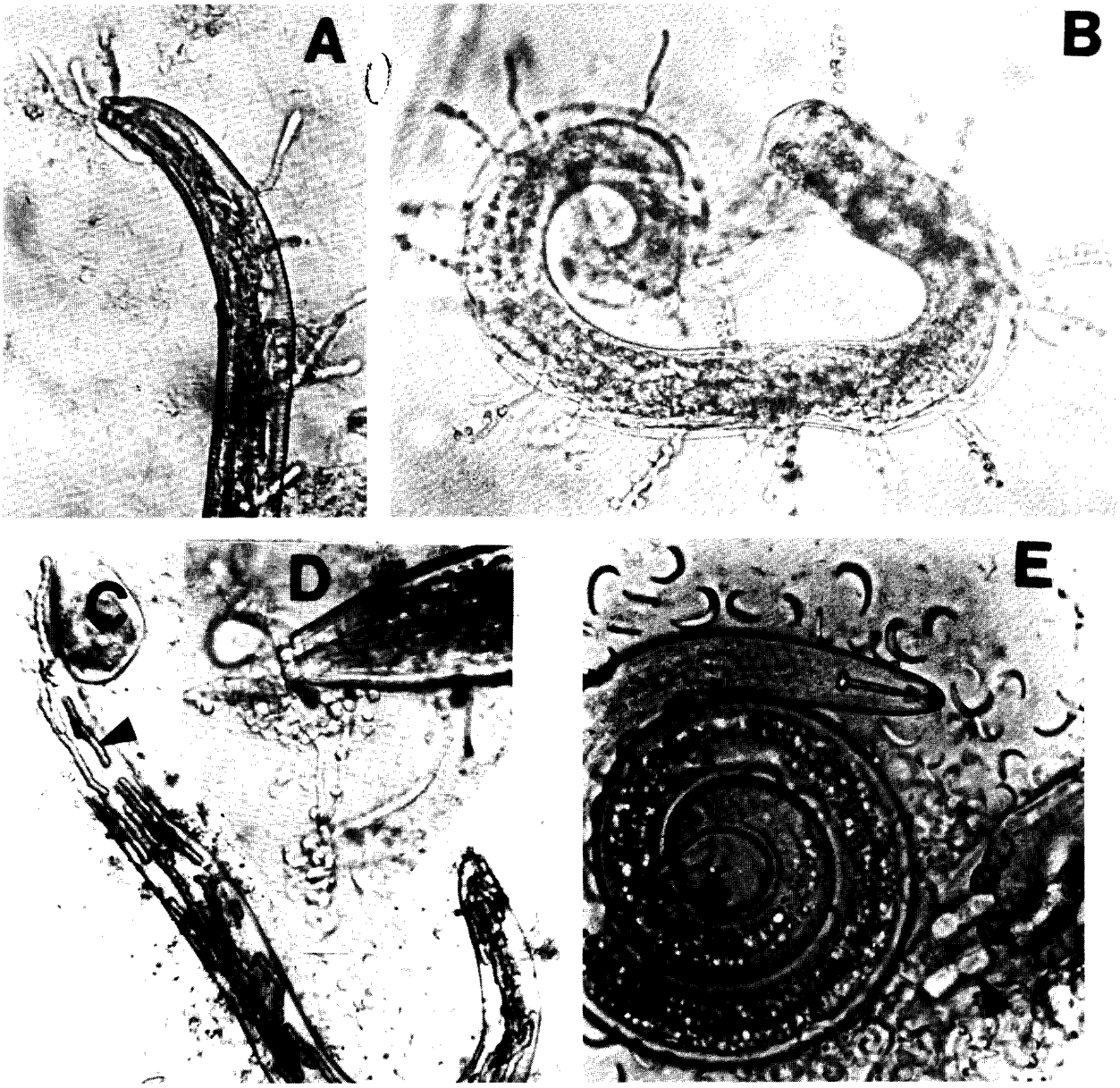
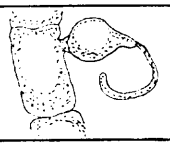
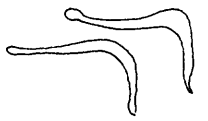
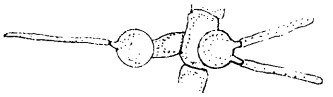
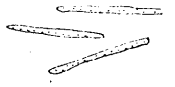
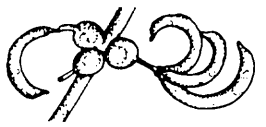
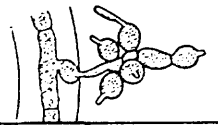
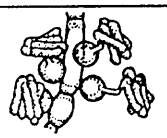
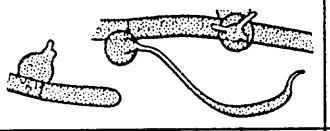
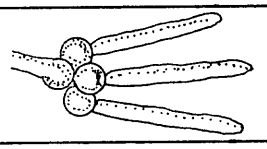
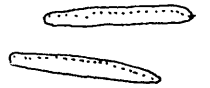
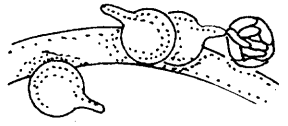
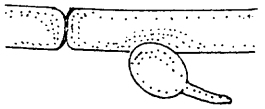
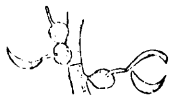
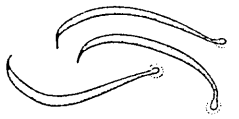
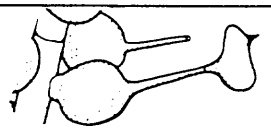
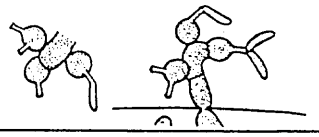
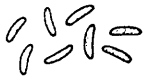
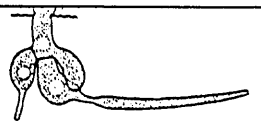


Fig. 2. *Harposporium anguillulae.* A. Immature conidiophores growing from a nematode body. B. Mature conidiophores protruding from a nematode body. C. Chlamydospores inside a nematode. D. An infected *Dorylaimus* sp. E. A healthy *Helicotylenchus dihystera* lying in a nest of conidia.

TABLE 1. SPECIES OF HARPOSPORIUM

SPECIES	AUTHOR/REF	PHIALIDES	CONIDIA	INFECTION MODE
anguillulae	Lohde/19/20			I,E
angularis	Barron/5			I
angustisporum	Monoson & Pikel			?
arthrosporum	Barron/4			I
baciliforme	Drechsler/12			I
botuliforme	Barron/6			I
bysmatosporum	Drechsler/10			I
codeatum	Drechsler/14			I
crassum	Shepard			?
cycloides	Drechsler/15			?
cylindrosporum	Barron/5			I
diceraeum	Drechsler/9			?
dicorhymbum	Drechsler/13			?

drechsleri	Barron/2			I
helicodes	Drechsler/9			I
leptospira	Drechsler/16			?
lillyputanum	Dixon/8			I
oxycoracum	Drechsler/9			I,E
reniforme	Patil & Pendse	?	?	?
rhynchosporum	Barron/3			?
sicyodes	Drechsler/12			?
spirosporum	Barron/7			I
subiliforme	Drechsler/11			E

INFECTION MODE CODE:

E - External: By conidia piercing or sticking to nematode body.
I - Internal: By swallowing condia.
? - Unknown

sp., a bacteriophagous nematode, ingested conidia of *H. bysmatosporum* (10) it gagged on the spores, ceased its leisurely manner of moving and feeding, assumed a violent locomotion mode, gradually slowed down and became sluggish, then quiescent and ultimately dead.

LIFE CYCLE: Spores in the alimentary canal of the nematode germinate, invade muscle tissue and enter the gut. Assimilative hyphae grow and branch, lysing internal organs and tissue until the prey is transformed into a hollow shell. A somewhat globular appressorium (Fig. 1-A) is produced from internal hyphae. The appressorium presses against the hypodermis of its host (1) producing a papillate bud (Fig. 1-B) that pierces the body wall and develops into an external conidiophore (Fig. 1-C, 2-A). Lateral buds form on the conidiophore (Fig. 1-D), producing globose phialides (Fig. 1-F) which are either sessile or on a short pedicel. Sterigmata are usually single but several may be present on one conidiophore as in *H. sicyodes* (Table 1). Conidia are produced singly (Fig. 1, inset) or in clusters (Table 1, *H. leptospira*). A mature conidiophore bearing many phialides (Fig. 2-B) is produced in 16-38 hours.

PREY: Principal prey of *Harposporium* are microbivorous nematodes such as *Acrobeles* spp., *Bunonema reticulatum* Richters, 1905, *Eucephalobus* spp., *Panagrellus redivivus* (Linnaeus, 1767) Goodey, 1945, *Plectus parvus* Bastian, 1865, *Prismatolaimus* spp., *Rhabditis* spp. and *Wilsonema* spp. One stylet-bearing phytoparasite, *Aphelenchoides* sp., has been reported as prey (17) and *H. anguillulae* has infected and killed *Dorylaimus* sp. (Fig. 2-D) on 3 observed occasions in Florida.

Live, healthy phytoparasitic nematodes in the genera *Criconemella* and *Helicotylenchus* have lain in a nest of *H. anguillulae* spores (Fig. 2-E) in excess of 2 weeks without becoming infected. *Harposporium* also parasitizes rotifers (4,5,6).

BIOLOGICAL CONTROL POTENTIAL: Since *Harposporium* species almost exclusively infect microbivorous nematodes and rotifers, one would assume a very low biological control function. Some microbivorous nematodes have ingested plant pathogenic fungus spores and excreted them in a viable state (18). It is conceivable that microbivorous nematodes could transport pathogenic disease spores to new sites (18).

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